

the base of each antenna; cheeks green. Thorax rather narrower than the width of the head across the eyes, convex, narrowed at the base, the anterior and posterior borders metallic, sprinkled with roundish tubercles; the disk gibbous. There is an obtuse tooth at the side just before each posterior angle; the base is gently arcuate, not lobed in the middle. Elytra narrowed at their base, dull black, slightly tinged with blue, the surface densely covered with conical tubercles which are directed backwards; each elytron has a small rusty spot near the base and another near the apex. The elytra are connate.

*Hab.* S.E. Africa, Lake Nyassa.

Brit. Mus.

A female example in Mr. Janson's collection has the elytra more ample, immaculate, and the sutural angle blunted.

LV.—On a Carboniferous *Hyalonema* and other Sponges from Ayrshire. By Professor J. YOUNG and Mr. J. YOUNG, F.G.S.

[Plates XIV. & XV.]

THE rotten limestones of Cunningham Baidland, near Dalry, in Ayrshire, were well known to Glasgow geologists, but, singularly enough, the value of their contents was unknown till the spring of 1876, when Mr. John Smith, of the Eglinton Ironworks, Kilwinning, washed the powdery débris and obtained, besides brachiopods, corals, &c., a quantity of sponge-spicules, which he submitted to us for identification. We exhibited Mr. Smith's collection to the British Association at its Glasgow Meeting in Sept. 1876, and in autumn to the Natural History Society. As no siliceous sponges had previously been found in our Carboniferous strata, we referred the spicules provisionally to M'Coy's Silurian genus *Acanthospongia*. In the same strata *Serpula parallela*, M'Coy, is abundant; and as a continental palæontologist, whose name we have unfortunately lost, had already identified this fossil as a glass sponge allied to *Hyalonema*, we suggested that the spicules and the glass rods might possibly be found to belong to the same organism.

In the 'Catalogue of Western Scottish Fossils,' prepared for the British Association Meeting of 1876, one of us briefly referred to the spicules and our conjecture of their being a part of a *Hyalonema*; but, in defect of direct evidence, the fossils were catalogued "*Acanthospongia Smithii*, Y. and Y., =

*Hyalonema (Serpula) parallelum*, M'Coy." Soon afterwards we found hexactinellid spicules on the same slab with *H. parallelum* (Pl. XIV. fig. 4), and rods identical with that fossil terminating in anchoring spicules (figs. 15, 16, 17). Nail-like and sexradiate spicules we had previously found in a matted mass (fig. 30).

The plates accompanying this paper were prepared early in the present year, and therefore do not include all the varieties which have since come into our possession through the kindness of Messrs. Smith and Armstrong. Mr. H. J. Carter, who published a preliminary note in the 'Annals' for September, and with whom we have since been in correspondence, has courteously postponed the publication of his second communication till we have made public the results at which we had previously arrived. The present communication has been delayed in the hope of obtaining further information as to the geological and chemical conditions under which the strata were deposited and subsequently altered; but as the accumulation of this kind of evidence is necessarily a slow process, we do not think it right longer to hold back our notes. We shall commence with the form which first secured our attention.

### 1. *Hyalonema Smithii*, Y. & Y.

*Serpula parallela*, M'Coy.

*Acanthaspongia Smithii*, Y. & Y.

Sponge-body unknown. Spicules of three kinds:—*a*, nail-like, some with four tapering, generally unequal, arms, a fifth projecting at right angles to these, others approaching the sexradiate type by the projection of a rounded, sometimes stalked, process opposite to the fifth; *b*, sexradiate, with the arms of various sizes but always projecting, and of various number, either by reduction or by the adhesion of other spicules; *c*, long, smooth, slender, tubular rods (the *Serpula parallela*, M'Coy), tapering towards the extremity and ending in the anchoring hooklets, the tip of the rod being either not, or only slightly, inflated. The rods are of unknown length, the longest fragments found at Trearne being 12 inches, and of various thicknesses from one fortieth of an inch to nearly a line in diameter; the central canal is capillary, making up from one sixth to one eighth of the total diameter. The fragments bearing the anchoring hooklets are from one eighth to five eighths of an inch in length. The sexradiate spicules range from one fourth to one eighth of an inch in diameter; the nail-like spicules from three eighths to one sixteenth of an inch in diameter.

*Locality.* Cunningham Baidland, Dalry, Ayrshire.

We have referred this sponge to *Hyalonema* rather than to *Rossella*, because the rope is shorter and the spicules are larger, though, on the other hand, the rods are smooth as in *Rossella*, not spinulose as in *Hyalonema*. The combination of characters might be less marked were we able to appropriate to our species the other kinds of spicules proper to it. The sponges previously found in British Palæozoic rocks are M'Coy's Silurian genus *Acanthaspongia*, Salter's Silurian genus *Amphispongia*, and Salter's Silurian genus *Protospongia*, the latter of which is placed by Zittel alongside of *Steganodictyum*, the two former, the first certainly, being referred to the Lyssakina of Marshall, in which *Hyalonema* is placed; but we do not propose to discuss their affinities so long as the information at our disposal is incomplete. We regret, however, that Zittel has (N. Jahrbuch, 1877, p. 371) placed our species in the subgroup Monakidæ of Marshall, and thus removed it from the Pollakidæ, among which *Rossella* and *Hyalonema* are found. While we think *H. Smithii* a good species, we do not say it is the only one. The variety in size of the sexradiate spicules is not necessarily a proof of specific diversity; it may only correspond to variety in age and size of the individuals. Among the many parcels of the rotten limestone which Mr. Smith has distributed, some may yield combinations of spicules *in situ*, throwing light on the specific unity or diversity.

The mode of fossilization of these objects is interesting. The rope is very widely distributed throughout the Scottish Limestones, and in all cases is siliceous; but its condition varies: on the one hand it is only slightly more opaque than the rope of recent forms; on the other, the siliceous material may (figs. 5, 6) have deserted its proper place and be found outside a circular empty tube in whose middle a siliceous rod represents the once empty canal. Again, the concentric lamination of the recent forms may be recognizable (fig. 9) even though the rod be compact, horny, and yellow; while, on the other hand, a rod of botryoidal chalcedony (fig. 10) may represent the once homogeneous cylinder. In fig. 1 some of the dark lines represent spaces from which the rods have disappeared, an irregular congeries of chalcedony spheroids taking their place. Lastly, another though rare modification is that by which (especially in the sexradiate spicules) the siliceous matter assumes a granular form. Evidence of the pressure to which the fossil has been subjected is given by the longitudinal grooves which adjacent rods have imprinted on each other, whether the pressure resulted from compression or from expansion of the silica during metamorphosis.

The following are the localities in which portions of *Hyalonema* are found besides Cunningham Baidland:—Auchenskeoch, Dalry, in shale, rope abundant in 3 or 4 inch lengths, spicules very rare; Howrat Quarry, Dalry, in limestone, rope only; Dockra, Hillhead, and Trearne quarries, near Beith, in limestone, rope; Waterland Quarry, Dunlop, Ayrshire, in weathered limestone, rope and spicules; Brockley, Lesmahagow, in shale, rope; Corrieburn, on the Campsie Hills, in shale, rope; Bathgate, in limestone and shale, rope; Chapel Quarry, near Kirkaldy, Fifeshire, in limestone on nearly the same horizon, rope. Doubtless the rope is found in many other districts, but the spicules, though found in one or two places by the Geological Survey, have only been got in abundance and good preservation in the Dalry district.

## 2. HAPLISTION, nov. gen. (Pl. XV. figs. 31–37.)

General form massive, spheroidal, attached (?). Skeleton composed of close-set similar fibres, which are collected into more compact bundles, and end at the surface with truncated extremities, between adjacent oscula or groups of oscula, this arrangement giving the fossil a very rugose aspect. Oscula numerous, inconspicuous, leading into canals which traverse the mass without forming definite cellular planes. No terminal aperture or internal cavity visible.

Species *Haplistion Armstrongi*, n. sp.

*Size.* Length five eighths, breadth three eighths of an inch.

*Locality.* Cunningham Baidland.

The three examples figured (the only ones which we possessed last year), a fourth belonging to Mr. Armstrong imbedded in a cake-like flint nodule, and a fifth which we believe identical, found at Arbigland by Mr. J. Thomson, are the only specimens of whose existence we are aware. No spicules have been recognized as belonging to the fossil, though the teased-out tissue lining the canals in fig. 34 has a tantalizing suggestion of spicules about it. The curiously parallel fibres, which seem to be not spinulose, terminate in the knobs (figs. 32, 33), so as to suggest the possibility of their having once projected free from the surface like the whiskers of *Labaria*. The sponge (figs. 31, 32, 33) is siliceous. Figs. 34–37 represent two which have undergone the change above referred to, having assumed a granular aspect, the distinctness of the component parts being at the same time impaired. It is not, therefore, absolutely certain that we have to do with a siliceous sponge; it may be that a horny sponge like *Dysidea* has become silicified, as have the brachio-

pod shells in the same deposit. The absence of a central cavity may be due to pressure by which the canals in fig. 34 are reduced in number, and certainly such pressure would affect a horny more readily than a siliceous sponge. The original of fig. 31 is of a greyish-white colour, and under the microscope has the look of grey pumice, so dry and harsh does it seem. We have been unable to separate fibres for examination by transmitted light, and doubt if they are sufficiently translucent to show any thing.

We have dedicated the species to Mr. J. Armstrong, a Glasgow palæontologist, to whom we owe this and many other interesting forms.

### 3. *A Species of the Group Gummina.*

The spicules (figs. 18, 28, 42, 43) so closely resemble the biternate spicules figured by Schmidt and others from *Corticium candelabrum*, that, though no birotulate spicules have been found, we think ourselves justified in referring these fossils to an allied genus. They are of gigantic size as compared with living forms; but they are so important a feature of the rotten limestone that we would name them provisionally *Chlamys magna*, so as to help future collectors and, it may be, hasten their identification with the parent organism, though the composition of the Gummina renders this last improbable. The drawings for this paper were completed in February last, before we had recognized their probable nature. We have now large series of specimens, which we shall illustrate later.

*Locality.* Cunningham Baidland.

### 4. *Incrusting Sponge?*

Plate XV. fig. 41 represents a curiously branched fragment which one of us (Mr. Young) thinks may be an incrusting sponge encasing an organism whose decay has left a hollow cast. These fragments are numerous, and present considerable diversity of form; but their structure is the same, granular and tinged yellow with iron. They have evidently undergone considerable metamorphism.

Mr. Carter has described ('Ann. & Mag. Nat. Hist.' 1873, xii. p. 458) a condition of the vitreohexactinellid sponges in which the vitreous fibre has become hollow by absorption of the hexactinellid spicules, and even of the vitreous fibre itself in part. There is no proof of any Carboniferous sponge belonging to the *Aphrocallistes* group; but it is possible that our fig. 41 may represent a fragment of *Haplition* incrusting



with siliceous matter which had or acquired the granular condition, and which has since been removed, leaving a hollow core to the incrustation (*cf.* Pl. XIV. figs. 5, 6).

### 5. *Unrecognized Forms.*

We have given a large number of drawings with the view of calling attention to certain forms whose identity is obscure or unknown to us.

A. Figs. 38–40 are of objects which we at first thought to belong to *Haplistion*; but we are now doubtful of the reference. They are silicified plates enclosing irregular cavities. They may be fragments of the skeleton of a hexactinellid sponge whose nail-like spicules have become deformed by siliceous deposit; but the possibility of their radiolarian character has been suggested.

B. The series figs. 42–51 represents objects which have some resemblance to part of the foregoing; but their variety is considerable, and we have not space to illustrate all the types.

C. The stellate spicules (figs. 13, 18, 19, 24, 26, 27, 29) have probably dropped out from other sponges. These spicules are of three kinds:—1, smooth (figs. 13, 18, 19, 26); 2, pustulate (figs. 27, 29); 3, cushioned (fig. 24). It is impossible to refer them to any of the species we have described; they may, indeed, be parts of forms not yet recognized.

### *Geological Position of the Sponges.*

The Carboniferous Limestone in West Scotland is divided into an upper and lower series by a mass of coals, ironstones, and shales, which are in part replaced in North Ayrshire by volcanic rocks. The Lower Limestones are again divided into an upper and lower group by from 10 to 40 feet of shales. The beds at Cunningham Baidland in which the sponges were found belong to the upper member of the Lower Limestones, in which group also volcanic rocks occur. The limestones show, when undenuded, a thickness of 40 feet (R. Craig "On the Carboniferous Basin of Dalry," *Trans. Geol. Soc. Glasgow*, iii. p. 275); but at Cunningham Baidland the quarry-section shows only between 20 and 30 feet. The rock is very much jointed, traversed by vertical fissures; and slicken-sided faces abound. At the north end of the quarry a narrow dyke of dolerite runs nearly east and west. These limestones are among the most fossiliferous in West Scotland; but the organisms are not equally distributed. Certain layers abound in the remains of Corals of different genera and species; in others Brachiopods, *Productæ*, &c. are the chief feature,

along with Polyzoa and Ostracoda; while another group is almost exclusively made up of the remains of large Crinoids. Cephalopods and Gasteropods are rare in this series of limestones; and the teeth of Placoid fishes are only occasionally met with. The Sponge-remains are not confined to a single horizon, though they appear to be more common in the shelly limestone. Neither are they restricted to the purer limestones, being found in the calcareous shales as well. The Central Scottish limestones were not deposited in so deep a sea as that in which the English limestones were laid down; and in the west of Scotland there is evidence of repeated oscillations, whose occurrence goes against the supposition that the water was deep. The shales which separate the sponge-bearing limestones from the inferior division of the Lower Limestone series are argillaceous and bituminous, with beds of foul coal and of volcanic ash; while above the upper division of the same series (that is, above the sponge-bearing beds), as at Trearne, *Stigmaria* and other coal-plants with carbonaceous shales tell of recurrent land and shallow water. From these considerations and from comparison of the list of fossils given by Mr. Craig in the paper above referred to, we do not think the *Hyalonema* lived in such deep water as do some, at least, of its modern representatives—not all, if *H. cebuense*, Higgins, was obtained by diving; for, as Mr. Higgins says, the depth could not, then, have exceeded 60 feet.

It is in the joints and fissures of the Cunningham-Baidland limestone that the sponges and other fossils have been found in most perfect condition amongst the weathered débris of the rock. The limestone in this quarry and generally throughout the district is greyish white; but the rotten limestone of the fissures is dark reddish brown, the colour being found, on analysis, to be due to the presence of iron associated with three or four per cent. of manganese. Distributed throughout the limestone in this and other quarries where it is worked are thin bands and nodular masses of greyish flint which enclose the organisms of the deposit, and which seem to have been formed by chemical segregation from silica in solution. Mr. R. O. Wood has suggested as the source of part, at least, of this silica, the volcanic rocks and ashes which are so plentiful in the superjacent strata; and the existence of thermal springs may also have had a share, as was suggested by Prof. Ramsay in the case of many of our altered Scottish limestones. To the possible presence of thermal springs Mr. Young is inclined to attribute the abundance of corals met with on this horizon throughout the western district. It is worthy of note that some of the apparently good limestones are unfit for the

furnace, on account of the quantity of silica which cements the organisms. The masses of flint seem in places to have squeezed the matrix around them as if by expansion. The calcareous organisms enclosed are entirely silicified, the calcite being wholly replaced.

#### EXPLANATION OF PLATES XIV. & XV.

[All the figures were drawn by camera lucida. Fig. 4 is natural size; the actual sizes of the others are indicated alongside of the figures.

I omitted to tell the lithographers that the plates had been drawn seven months ago, and had not been retouched. Where the finer lines were found to have disappeared the lithographers took every pains to compensate for my neglect.]

A., specimens in Mr. Armstrong's Cabinet; S., in Mr. Smith's;  
Y., in Mr. Young's.

Fig. 1. *Hyalonema Smithii*, n. sp. Fragment of rope. Cunningham Baidland. Y.

Fig. 2. End view of same specimen.

Fig. 3. *H. Smithii*. A few of the rods, enlarged, to show varying diameters in bundle.

Fig. 4. The same, showing sexradiate spicules alongside of rope. Auchen-skepch. Y.

Figs. 5 and 6. The same, showing removal of rod and replacement of central canal by siliceous rod. Y.

Figs. 7 and 8. The same, transverse section of rods. Y.

Fig. 9. The same, vertical section of rod, showing central canal and striæ answering to concentric layers. Y.

Fig. 10. The same, botryoidal structure. Y.

Figs. 11, 12, 12 a, 14, 20, 21, 22, 23. The same, sexradiate spicules of various types. Y.

Figs. 13, 19, 26. The same, stellate spicules, smooth. Y.

Figs. 15, 16, 17, 25. The same, anchoring hooklets. Y.

Fig. 24. Stellate spicule, cushioned. Y.

Figs. 27, 29. Stellate spicules, pustulate. Y.

Figs. 18, 28, 42, 43. *Chlamys magna*. Biternate spicules. Y. and S.

Fig. 30. *Hyalonema Smithii*. Nail-like spicules matted together in position.

Fig. 31. *Haplition Armstrongi*, n. sp. A.

Figs. 32, 33. The same. Successive enlargement of part of surface of fig. 31. In fig. 33 the simple fibres are well seen, and their truncated ends on the knobs.

Figs. 34, 35. The same. Opposite faces of another specimen, showing oscula and internal canals. A.

Fig. 36. The same. Enlargement of part of fig. 34.

Fig. 37. The same, showing unusually prominent ridges. A.

Figs. 38, 39, 40. Undetermined forms. S.

Fig. 41. Incrusting sponge?, hollow, tubular. Y.

Figs. 44-51. Various branching forms from the rotten limestone. S.